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# Facebook Hacker Cup 2018 Round 1

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## Evening of the Living Dead

37 points

Download Input

A quiet evening has set over a residential area. As families sit down for supper in the safety of their homes, a calm atmosphere permeates the outside air. The neighborhood feels truly at peace, separated from the frenzy of the rest of the world. Also, a bunch of zombies have just risen out of the ground and want to eat everybody.

The neighborhood has **N** yards in a row, numbered from 1 to **N**. There are also **N**-1 fences, one between each pair of adjacent yards. The fence between yards *i* and *i*+1 has an unknown integral height drawn uniformly at random from the inclusive interval [$A_i$, $B_i$]. In other words, the *i*th fence has $B_i$ - $A_i$ + 1 possible heights, each of which is equally likely.

**M** hungry zombies are also present, with the *i*th of them initially in yard $Y_i$. Fortunately for the zombies, they might not be stopped by the surrounding fences so easily. The *i*th zombie has the ability to climb over any fence with a height of at most $H_i$. It may repeatedly move from its current yard to an adjacent one, as long as the fence between the yards is no taller than $H_i$. Multiple zombies may start in the same yard, and multiple zombies may occupy the same yard at any point.

A yard is considered "safe" if it's impossible for any zombies to ever reach it. Determine the probability that at least one of the **N** yards is safe. Let this probability be represented as a quotient of integers *p*/*q* in lowest terms. Output the value of this quotient modulo 1,000,000,007 — in other words, output the unique integer *x* such that 0 ≤ *x* < 1,000,000,007 and *p* = *x***q* (modulo 1,000,000,007).

### Input

Input begins with an integer **T**, the number of neighborhoods. For each neighborhood, there is first a line containing the space-separated integers **N** and **M**. Then, **N-1** lines follow. The *i*th of these lines contains the space-separated integers $A_i$ and $B_i$. Then, **M** lines follow. The *i*th of these lines contains the space-separated integers $Y_i$ and $H_i$.

### Output

For the *i*th neighborhood, print a line containing "Case #*i*: " followed by 1 integer, the probability that at least one of the yards is safe, expressed as a quotient of integers modulo 1,000,000,007.

### Constraints

1 ≤ **T** ≤ 75
1 ≤ **N** ≤ 3,000
1 ≤ **M** ≤ 3,000
1 ≤ $A_i$ ≤ $B_i$ ≤ 1,000,000
1 ≤ $Y_i$ ≤ **N**
1 ≤ $H_i$ ≤ 1,000,000

### Explanation of Sample

In the first case, if the height of the single fence is 100, then the zombie in yard 1 will be able to climb over it to reach yard 2, meaning that no yards will be safe. Otherwise, if the fence's height is 101, then yard 2 will be safe. Therefore, the probability that at least one of the yards is safe is 1/2 = 500000004 (modulo 1,000,000,007).

In the second case, in order for yard 2 to be safe from both surrounding zombies, the first fence's height must be either 3 or 4, and the second fence's height must be 4. The probability of this occurring is 2/4 * 1/4 = 1/8 = 125000001 (modulo 1,000,000,007).

In the third case, the probability of at least one yard being safe is 2/3 = 666666672 (modulo 1,000,000,007).

Sample input · Download

```
6
2 1
100 101
1 100
3 2
1 4
1 4
1 2
3 3
4 2
1 4
1 2
3 5
4 3
3 1
6 3
1 20
2 19
3 18
4 17
5 16
6 9
1 13
```

Sample output · Download

```
Case #1: 500000004
Case #2: 125000001
Case #3: 666666672
Case #4: 417224706
Case #5: 441220242
Case #6: 292643605
```

```
6 3
1 20
2 19
3 18
4 17
5 16
4 9
3 13
4 7
16 10
10 40
5 55
20 25
25 50
40 65
35 50
15 20
10 35
15 55
10 70
25 60
5 50
20 50
10 30
15 55
9 32
14 48
5 34
13 41
7 35
2 19
13 20
5 17
3 33
11 24
```